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APPEAL BRIEF

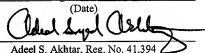
Appellant : Satoh et al.
 App. No : 10/759,953
 Filed : January 16, 2004
 For : SEMICONDUCTOR-PROCESSING
 DEVICE PROVIDED WITH A
 REMOTE PLASMA SOURCE FOR
 SELF-CLEANING
 Examiner : Jeffrie Robert Lund
 Art Unit : 1763

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Commissioner for Patents

P.O. Box 1450

Alexandria, VA 22313-1450

Dear Sir:

This Appeal Brief relates to an appeal to the Board of Patent Appeals and Interferences of the rejections set forth in the Office Action having a notification date of April 1, 2008, the Office Action having a notification date of August 2, 2007, the Advisory Action having a notification date of February 2, 2007, and the Final Office Action having a mailing date of November 16, 2006 in the above-captioned application.

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I. REAL PARTY IN INTEREST

The real party in interest in this appeal is the assignee of this application, ASM JAPAN K.K.

II. RELATED APPEALS AND INTERFERENCES

Appellants are unaware of any related appeals or interferences.

III. STATUS OF CLAIMS

Claims 1-3, 5, 6, 8-10, 14-19, and 45 are currently pending and are the subject of this Appeal; Claims 1 and 9 are the only independent claims. All of these claims are rejected as obvious under a variety of grounds as detailed below. Claims 11-13 have been withdrawn. Claims 4, 7, and 20-44 have been cancelled. The appealed claims are attached hereto as Appendix A.

IV. STATUS OF AMENDMENTS

The claims before the Board appear as they were rejected in the non-final Office Action mailed April 1, 2008. No further amendments were made to the claims after these rejections. These pending claims are attached hereto as Appendix A.

V. SUMMARY OF CLAIMED SUBJECT MATTER

The invention relates generally to a CVD device with a remote plasma source for cleaning a deposition chamber of the CVD device. More specifically, the invention involves a remote plasma discharge chamber having walls made of an aluminum alloy (*see, e.g.* ¶¶ 0023 and 0024 of the published version of U.S. App. No. 10/759,953, hereinafter the “953 Application”). The remote plasma discharge chamber has a source of RF energy associated with it (*see, e.g.*, ¶¶ 0019, 0023, and 0024). Additionally, the invention further involves a specific type of valve positioned in a piping connecting the CVD chamber and the remote plasma discharge chamber. The valve of Claim 1 has an opening that, when fully opened, defines a pressure drop across the

valve of less than about 0.25 Torr (§ 0023). The valve of Claim 9 has an opening that is sized so that, when the valve is fully opened, the opening is substantially equal in width to an inner surface of the piping and the valve does not have projections with respect to the inner surface of the piping (*see, e.g.*, abstract, §§ 0021, 0023, 0026, 0112, FIG. 4A, and FIG. 4B, original Claims 7, 27, and 9). In general, these particular valves minimize recombination of the cleaning gas and allow for faster cleaning rates for the device (§ 0026). Each of the elements of the independent claims is discussed in more detail below.

Claim 1 recites, with reference to FIGS. 3-5:

A chemical vapor deposition (CVD) device 1 comprising

a deposition reaction chamber 2; (§§ 0003 and 0136)

a plasma discharge chamber 13 that is provided remotely from the reaction chamber 2 (abstract, §§ 0009, FIG. 5); wherein the plasma discharge chamber 13 comprises (1) a wall that comprises an aluminum alloy, wherein the wall is exposed to plasma discharge (§§ 0023, 0024, 0082), and (2) a radio-frequency (RF) energy source connected to plasma discharge chamber electrodes (§§ 0019, 0111, and 0024);

a source 163 of a cleaning gas, wherein the source of the cleaning gas is connected to the plasma discharge chamber 13 (§ 0152, FIG. 5);

a piping 14 that links the reaction chamber 2 and the remote plasma discharge chamber 13 (abstract, FIG. 3); and

a valve 15 positioned in the piping 14, wherein the valve 15 has an opening 22, 23 that, when fully open, defines a pressure drop across the valve 15 of less than about 0.25 Torr (§§ 0023, 0099, FIGs. 4A and 4B),

wherein energy coupled to the remote plasma discharge chamber 13 activates cleaning gas within the plasma discharge chamber 13, and the activated cleaning gas is exposed to the aluminum alloy wall and brought into the inside of the reaction chamber 2 through the piping 14 and changes solid substances adhered to the inside of the reaction

chamber 2 as a consequence of film formation, to gaseous substances, thereby cleaning the inside of the reaction chamber 2 (¶¶ 0018, 0082).

Claim 9 recites, with reference to FIGS. 3-5:

A chemical vapor deposition (CVD) device comprising:

a deposition reaction chamber 2; (¶¶ 0003 and 0136)

a plasma discharge chamber 13 that is provided remotely from the reaction chamber 2 (abstract, ¶ 0009, FIG. 5); wherein the plasma discharge chamber 13 comprises (1) a wall that comprises an aluminum alloy, wherein the wall is exposed to plasma discharge (¶¶ 0023, 0024, 0082), and (2) a radio-frequency (RF) energy source connected to plasma discharge chamber electrodes (¶¶ 0019, 0024);

a source of a cleaning gas 163, wherein the source of the cleaning gas 163 is connected to the plasma discharge chamber 13 (¶ 0152, FIG. 5);

a piping 14 that links the reaction chamber 2 and the remote plasma discharge chamber 13 (abstract, FIG. 3); and

a valve 15 positioned in the piping 14, wherein an opening 22, 23 of the valve 15 is sized, when fully opened, substantially equal in width to an inner surface of the piping 14, and the valve 15 does not have projections, when fully opened, with respect to the inner surface of the piping 14 (¶¶ 0023, 0099, FIGS. 4A and 4B),

wherein energy coupled to the remote plasma discharge chamber 13 activates cleaning gas within the plasma discharge chamber 13, and the activated cleaning gas is exposed to the aluminum alloy wall and brought into the inside of the reaction chamber 2 through the piping 14 and changes solid substances adhered to the inside of the reaction chamber 2 as a consequence of film formation, to gaseous substances, thereby cleaning the inside of the reaction chamber 2 (¶¶ 0018, 0082).

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Claim 19 recites the CVD device of Claim 14, wherein when the valve 15 is open, a cleaning gas can flow from the remote plasma discharge chamber 13 to the reaction chamber 2 without obstruction, and wherein the piping 14 is at least 1/2 inch in diameter (§ 0012). Claim 14 depends from Claim 1 and recites that the piping is straight between the remote plasma discharge chamber and the reaction chamber (Original Claim 14).

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

As a first general grounds of rejection, the Examiner has rejected Claims 1-3, 5, 6, 8, 9, 15, 16, and 45 under 35 U.S.C. §103(a) as being unpatentable over Fong et al. (U.S. Pat. No. 5,812,403, hereinafter "Fong"), in view of Lorimer et al. (U.S. Pat. No. 5,069,938, hereinafter "Lorimer"), and Iyer et al. (U.S. Pat. No. 6,498,109, hereinafter "Iyer"). These references constitute the core combination for the Examiner's below rejections.

As a second general grounds of rejection, the Examiner has rejected Claims 1-3, 5, 6, 8, 9, 15, 16, and 45 as being unpatentable over the above core combination, further in view of Hackman et al (U.S. Pat. No. 3,963,214, hereinafter "Hackman").

In addition, the Examiner rejected Claims 14 and 17-19 over the core combination in view of Noble et al. (U.S. Pat. No. 6,450,116, hereinafter "Noble") and, alternatively, the core combination in view of Noble and Hackman. The Examiner has also rejected Claim 10 over the core combination in view of Ikeda et al. (U.S. Pat. No. 6,033,479, hereinafter "Ikeda") and, alternatively, the core combination in view of Ikeda and Hackman.

Appellants reserve the right to separately argue individual claims of the above groups in subsequent continuing applications, with respect to the patentability of various dependent features not addressed herein.

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VII. ARGUMENT

A. *Adjustment to Prior Rejections*

This appeal is the third appeal brief filed for the same claims, attached herewith (Appendix A). The two previous appeals were withdrawn by the Patent Office by the issuance of additional Office Actions.

In the most recent Office Action, dated April 1, 2008, the Examiner has replaced the primary reference Shang et al (EP 0697467, herein after Shang ('467')) with a previously cited reference Fong et al. (U.S. Pat. No. 5,939,831, hereinafter "Fong"). In the previous Office Action, dated August 2, 2007, Fong served as a secondary reference. It appears that the Examiner is under the impression that by replacing Shang with Fong, the Examiner can ignore the clear and directly on-point teachings away of Shang (as well as numerous additional references, all of record), over the Examiner's current combination of Fong and the other secondary references. Appellants respectfully submit that this is clearly incorrect and that the prior art as a whole, including unasserted references, must be considered in determining whether or not one of skill in the art would have had any reason to combine the various aspects noted by the Examiner, in the manner claimed. Thus, regardless of this minor shifting in cited art, the Examiner has continued to ignore the clear and numerous teachings away in the art. Indeed, in the most recent Office Action, the noted teachings away in the art of record (which were noted in the previous two Appeal Briefs) have not even been addressed. As such, it is clear that the Examiner has failed to consider the art as a whole and the teachings away from the claimed combination, and indeed continues to believe that he need not consider references that are not used in rejections (as the Examiner has explicitly stated in earlier Office Actions). As noted before and noted again below, the prior art, as a whole, teaches away from the claimed invention, *i.e.*, discourages the claimed combination. This, and further deficiencies in the rejections, are described in more detail below.

B. The Examiner's Asserted Rejections Regarding Independent Claims 1 and 9

Under both general grounds of rejection, the Examiner has asserted that Fong teaches a chemical vapor deposition (CVD) device involving a deposition reaction chamber and a remote plasma discharge chamber (having an RF plasma source) for a cleaning gas (remote microwave plasma system). The Examiner has further asserted that Fong teaches a valve (280, "gate valve") configured as recited in the claims (Claim 1: a valve that has an opening that when fully open defines a pressure drop across the valve of less than about 0.25 Torr, or Claim 9: a valve that has an opening that is sized so that when the valve is fully opened the opening is substantially equal in width to an inner surface of the piping, and the valve does not have projections, when fully opened, with respect to the inner surface of the piping). The Examiner has asserted that Lorimer teaches a corrosion-resistant protective coating over aluminum surfaces exposed to halogen gases and plasmas. The Examiner has asserted that Iyer teaches a remote plasma discharge chamber with oppositely placed electrodes that can deliver power between 50 W and 5 kW at a frequency between 10 kHz and 200 MHz.

Under the second general grounds of rejection the Examiner has asserted the same combination of Fong and Iyer, as above, and has further asserted that Hackman teaches a valve configured as recited in the claims; thereby making up for any deficiency that Fong may have in this area. (Office Action mailed April 1, 2008, page 7). Hence, the Examiner has asserted that one would have been motivated to replace the generic gate valve of Fong with the valve of Hackman to provide a specific gate valve as required by Fong et al but only generically described.

C. Legal Requirements for Establishing a Showing of Obviousness

The Examiner bears the initial burden to establish and support a *prima facie* case of obviousness.¹ To establish a *prima facie* case of obviousness, all the claim limitations must be

¹ See *In re Rinehart*, 531 F.2d 1048, 189 U.S.P.Q. 143 (C.C.P.A. 1976).

taught or suggested by the prior art.² Additionally, to establish a *prima facie* case of obviousness, some reason, either in the references or in the knowledge generally available among those of ordinary skill in the art, to modify the reference should be provided by the Examiner.³ Finally, even once a *prima facie* case of obviousness is established, it can be rebutted in situations in which the art taught away from the claimed combination.⁴ Where the teachings of two or more prior art references conflict, the examiner must weigh the power of each set of references to suggest solutions to one of ordinary skill in the art, considering the degree to which one set of references might accurately discredit another.⁵

D. Deficiencies in the Rejections.

Appellants respectfully submit that the Examiner's rejections are insufficient because (1) the Examiner continues to ignore teachings away in the relevant art with respect to the claimed combinations; (2) the rejections fail to cite a specific reason for the asserted combinations, specifically for combining the valve allegedly taught in Fong (or Hackman) with the other references that allegedly teach the type of remote plasma system of the claims; and (3) in regard to the first general grounds of rejection, not all of the claim limitations are met inherently by the

² See *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974).

³ See *KSR International v. Teleflex*, 127 S.Ct. 1727 at 1741 (2007) ("it can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does."), see also, *In re Vaeck*, 947 F.2d 488 (Fed. Cir. 1991). "The references themselves, not the invention itself, must provide some teaching whereby the appellant's combination would have been obvious." *In re Forman*, 933 F.2d 982 (Fed. Cir. 1991); *Heidelberger Druckmaschinen AG v. Hantscho Commercial Products, Inc.*, 21 F.3d 1068 (Fed. Cir. 1993).

⁴ The totality of the prior art must be considered, and proceeding contrary to accepted wisdom in the art is evidence of nonobviousness. *In re Hedges*, 783 F.2d 1038, 228 USPQ 685 (Fed. Cir. 1986); *In re Geisler*, 116 F.3d 1465, 1471, 43 U.S.P.Q.2d 1362, 1366 (Fed. Cir. 1997); and *KSR International*, 127 S.Ct. 1727 at 1740 ("when the prior art teaches away from combining certain known elements, discovery of a successful means of combining them is more likely to be nonobvious.")

⁵ See *In re Young*, 927 F.2d 588, 18 USPQ2d 1089 (Fed. Cir. 1991).

asserted combinations because the "gate valve" of Fong would not inherently meet the claim limitations related to pressure drop or full opening width, and the Examiner provides no reason to select or modify a gate valve to meet those limitations⁶.

1. The Examiner Ignores Teachings Away in the Prior Art

a. It is Legal Error for the Examiner to Ignore Teachings in the Prior Art.

The Examiner has improperly ignored clear teachings away from the presently claimed combination in making the rejections. Indeed, the Examiner has previously explicitly ignored numerous relevant references that taught the value of restricting the flow of gas in the claimed context (*i.e.*, between a remote plasma for cleaning gas and a downstream CVD chamber) and therefore taught away from the application of the recited low pressure drop (Claim 1) or fully opening valve (Claim 9). Indeed, the following findings of the Examiner are clearly legally incorrect:

The argument that "The Prior Art Taught Away from the Use of a Through-Flow Valve in Cleaning" is moot because does not matter what the prior art, not used in the rejection, teaches. Only the teachings of the prior art used in the rejection are relevant.

(Final Office Action mailed November 16, 2006, page 9). Similarly, the Examiner also stated that:

The arguments directed to Shang et al. U.S. Patent No. 5,788,778 are moot because Shang et al, US patent 5,788,778 is not used in the present rejections.

(Final Office Action mailed November 16, 2006, p. 8).

In a subsequent Office Action, the Examiner did not repeat these plainly incorrect statements, but did not withdraw them and also offered reasons why teachings away do not need to be considered. In the most recent Office Action, the Examiner has continued to fail even to address the teachings away in the art as a whole. Moreover, it is clear from the Examiner's

⁶ Appellants note that two references cited in the rejection of some of the dependent claims, Ikeda and Noble, do not overcome the noted failings or alter the analysis with respect to the independent claims and are not relevant to the present arguments.

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withdrawal from appeal solely to omit the assertion of Shang (one of the references that reaches away), that the Examiner still believes that, by not including a reference in the rejection itself, he can ignore the clear teachings away in that reference. However, it is well established that the totality of the prior art must be considered, and that proceeding contrary to accepted wisdom in the art is evidence of nonobviousness. (See, *In re Dow Chemical Co.*, 837 F.2d 469, 473, 5 USPQ2d 1529, 1532 (emphasis added, Fed. Cir. 1988) ("...the full field of the invention must be considered... the person of ordinary skill is charged with knowledge of the entire body of technological literature, including that which might lead away from the claimed invention.")).⁷

As noted above, the present Office Action appears to be completely silent in regard to the previously noted teachings away in the art of record. Moreover, even in the previous Office Actions, the Examiner merely stated that "[t]he Applicant has ignored the teaching of Fong et al, which is part of the prior art and clearly teaches the use of gate valves." (Office Action mailed August 2, 2007, page 16). Even assuming, *arguendo*, that Fong teaches the relevant valve (Appellants note that it does not, see the discussion in the last section below), it is clear that the Examiner is not weighing the teachings of the art away from the claimed combination. Mere presence of a feature, with no reason to select it from among other options in the art, cannot rebut clear teachings away.

In light of the clearly erroneous legal standard applied by the Examiner, and the clear teachings away discussed below, Appellants submit that, even if a *prima facie* case of obviousness had been established, it would have been rebutted by the clear teachings away in the art.

b. The Prior Art Taught Away from the Use of a Through-Flow Valve in Cleaning.

The art of record specifically taught to restrict the flow between the two chambers during cleaning, often through the use of the valve itself. As such, the art taught away from a valve configured so as to minimize the interaction between the valve body and the flow path when

⁷ See also *In re Hedges*, 783 F.2d 1038, 228 USPQ 685 (Fed. Cir. 1986)

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open. The fact that this was the current understanding in the art at the time of the invention is noted in the present application (*see, e.g.*, ¶¶ 0009-0011 and 0042 of the '953 Application). Appellants note that none of the asserted art contradicts this. Indeed, as detailed below, most of the references clearly support this concept, explicitly or implicitly.

For example, U.S. Pat. No. 5,788,778 (hereinafter "the '778 patent", teaches away from the presently recited valve. The '778 patent teaches the use of a "flow restrictor" to prevent the free flow of gas between a remote chamber and the deposition chamber during operation. "A flow restrictor 59 is employed in pipe 57. Flow restrictor 59 may be placed anywhere in the path between remote chamber 46 and deposition chamber 10." (col. 4, lines 48-50). Indeed, the type of valve disclosed in the '778 patent, a "needle valve," is disclosed as useful because it creates a significant pressure differential. (col. 5, lines 22-30). Thus, the '778 patent clearly teaches creating a pressure differential in the piping between the remote plasma unit and the CVD chamber, while the presently recited valve features (low pressure drop or no internal projections when open) accomplish just the opposite, minimizing any pressure differential created when fully opened. Again, as noted above, during prosecution the Examiner has explicitly, and improperly, ignored the explicit teachings of the '778 patent. In light of this very clear teaching away, Appellants submit that even if a *prima facie* case had been established, it would have been rebutted.

Appellants note that the '778 patent is not the only reference in the art that generally teaches the restriction of gas flow between a remote plasma cleaning chamber and a CVD chamber. For example, Sun et al. (U.S. Pat. Pub. No. 2002/0033183) actually teaches that the "valve" 62 is a flow restrictor which is used to maintain a desired pressure differential between the remote plasma chamber and the deposition chamber (*see, e.g.*, 0013). Thus, Sun also directly teaches away from a valve that has the recited features (low pressure drop or lack of internal projections when open). Additionally, U.S. Pat. No. 6,274,058 teaches a valve 80 that is positioned between a remote cleaning chamber and a processing chamber and is used to adjust and control the flow rate of the cleaning vapor. Thus, there are a number of references that not only teach that a valve designed and configured for restriction or control should be used, but

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explicitly teach that this ability to restrict or control the flow of the gas is an important aspect that a valve should possess. The skilled artisan would understand these teachings to steer away from the presently recited type of valve. The references asserted by the Examiner contain no teachings to counter those very specific and clear teachings away.

Furthermore, in addition to the above references that explicitly note specific aspects regarding the valves, there are also numerous references that teach other features inconsistent with the features of the valve recited in the present claims. For example, the previously cited Shang EP application ('467) (*see, e.g.,* Office Action mailed August 2, 2007) teaches that a filter 56 should be placed between the remote chamber 46 and the processing chamber. It is noted that the use of filters in this location will result in the restriction of the flow of gas, making the previously asserted combination of a fully opening gate valve (with low pressure drop or no internal projections when open) would be pointless modification of Shang '467.

Fong does not rebut the teachings away. On the contrary, Fong is consistent with the restrictions taught as desirable in the art. For example, Fong teaches the presence of a mixing box 273 between the two reaction chambers. As is clearly depicted at the bottom of the mixing block, while the outer passage 297 is the same diameter as the passage 293 that includes the valve 280, there is an inner passage 295 that is contained within the outer passage, thereby restricting the flow of gas through the passage 297. Thus, Fong appears to teach that the flow path between the two chambers can and should be restricted, at least in the mixing block, and certainly does not teach or suggest that the passage should be free of restrictions when in use.

Appellants submit that the art, when considered as a whole, teaches away from the use of valves with the presently recited features in the recited apparatus because the art was focused on slowing, restricting, and controlling the flow between the remote plasma chamber and the deposition chamber, rather than using a device that minimizes pressure differences on either side of the valve. Indeed, the benefits of the recited valves are opposite in nature to flow restricting valves or filters. As the art clearly taught that items that obstructed/restricted the flow of gas were desirable and standard, it is clear that the art taught away from a valve that "when fully open, defines a pressure drop across the valve of less than about 0.25 Torr" (Claim 1) or a valve

that “is sized, when fully opened, substantially equal in width to an inner surface of the piping, and the valve does not have projections, when fully opened, with respect to the inner surface of the piping” (Claim 9).

c. The Examiner’s Characterization of Fong’s Teaching of the Gate Valve does not Rebut the Teachings of the Importance of Flow Restriction

The Examiner appears to assert that the Appellants have ignored the teachings of Fong and his “gate valve” in considering the art as a whole. Appellants respectfully disagree. Rather, Appellants submit that Fong’s vague reference to an optional gate valve, without any explanation of why or how a gate valve might be useful, does not rebut the clear and explicit teachings away in the above noted art and in the field in general. While the Examiner chooses to employ Fong’s vague and passive teachings, without any explicit benefits, in combination with the type of plasma chamber recited, the art as a whole clearly steers away from that choice.

As noted above, Fong teaches that the flow path between the chambers is at least restricted in the mixing block. Thus, if anything, Fong would actually suggest that flow restriction between these two chambers is acceptable and expected. As such, Appellants see little reason why Fong’s vague use of a generic and optional “gate valve” should rebut the clear showing in the art (including Fong itself) that flow restriction was common and important in these arrangements.

Appellants note that, even if one were to assume that Fong’s vague teachings regarding an optional valve could be interpreted as some suggestion to avoid flow restriction, Appellants submit that this suggestion would be insufficient. In such a case, where the teachings of two or more prior art references conflict, the Examiner must weigh the power of each reference to suggest solutions to one of ordinary skill in the art, considering the degree to which one reference might accurately discredit another.⁸ If this is done, Appellants submit that greater reliance ought to be placed upon the above discussed art (and previously submitted Declaration) rather than the

⁸ See *In re Young*, 927 F.2d 588, 18 USPQ2d 1089 (Fed. Cir. 1991).

teachings of Fong. This is because Fong itself refers to his valve 280 as an optional⁹ valve, with no discussion at all of any advantages for its use. Moreover, Fong includes a subsequently positioned mixing block that would restrict the flow of a gas through the piping. This defeats any purpose there might be in using a non-restrictive valve, as recited in the claims.

In contrast to Fong's general disclosure, the references that Appellants cite explicitly disclose the role that those prior art valves and devices play in the system. In light of this choice, one of ordinary skill in the art would give these later specific teachings greater credibility over any vague, optional suggestions in Fong, especially when the Examiner's interpretation of Fong appears to be inconsistent with the other aspects in Fong's device.

Finally, in a previous Office Action, the Examiner asserted that one of skill in the art would have been aware of the general uses of gate valves and the specific use of gate valves in Fong et al. (Office Action mailed August 2, 2007, p. 16). By this statement, the Examiner appears to be implying that Fong teaches a valve in which the valve body is necessarily capable of being completely removed from the flow path. As noted below, Fong's teaching of an optional "gate valve" does not actually teach the type of valve that is recited in the present claims. As such, Appellants submit that this is not a situation where the art is simply teaching alternative ways of doing something (because Fong does not teach a low pressure drop or fully opening valve as recited), but rather, this is a situation where the art clearly teaches away from the properties of the presently recited valve. The mere fact that Fong calls his valve a "gate valve" does not give the skilled artisan a reason to go against the teachings away and include the actually recited elements.

Appellants note that the above teaching away arguments apply equally to both the first and second general grounds of rejection and that Hackman does not address or rebut any of the above noted failings of the Examiner's rejection.

⁹ Col. 26, lines 19 & 20.

2. No Positive Reason is Given for Why One of Skill in the Art Would Have Chosen the Specific Valve for the Specific Combination.

As explained in the following section, the “gate valve” in Fong does not appear to inherently be the gate valve that is recited in either Claims 1 or 9. Thus, in order to establish a *prima facie* case of obviousness, the Examiner must provide a reason to use a gate valve with the specifically recited properties. Appellants note that it is important for the Examiner “to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does.” (*KSR International v. Teleflex*, 127 S.Ct. 1727 at 1741 (2007)).¹⁰

In regard to the various valves available, Appellants note that numerous references taught a variety of valves in the same or similar location as Fong. For example, Shang (*778), taught that a needle valve is to be used between a remote plasma cleaning chamber and a CVD chamber (*i.e.*, exactly at the recited location).¹¹ Furthermore, other references taught numerous valve types (*e.g.*, Yin et al., PCT Pub. No. WO 99/20812, item 225, FIG. 4; Sun et al., Pat. Pub. No. 2002/0033183, item 62; and Fukuda et al., U.S. Pat. Pub. No. 2005/0139578, item 15) that were also employed.

What is clear from these references, and the art in general, is that one of skill in the art was aware of numerous types of valves that could be employed. However, what is not clear from the cited art and the Office Action is why one would have used a gate valve with the specifically recited properties, as opposed to the generic idea of a gate valve taught in Fong.

Appellants submit that the Examiner is actually using hindsight, based on the current claims, to mold the combination of the elements taught in the various cited references into

¹⁰ See also *In re Deuel*, 51 F.3d 1552 at 1558-59 (Fed. Cir. 1995); *In re Baird*, 16 F.3d 380 at 382-83, 29 U.S.P.Q.2d at 1552 (Fed. Cir. 1994); and *In re Bell*, 991 F.2d 781 at 784, 26 U.S.P.Q.2d at 1531 (Fed. Cir. 1993).

¹¹ “Flow restrictor 59 may be, for example, a small orifice or a series of small orifices, although any device that creates a pressure differential, such as a reduction valve or a needle valve, could be employed.” (Col. 5, lines 26-31)

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something that will cover the claimed invention. However, “[o]bviousness can not be established by hindsight combination to produce the claimed invention . . . [I]t is the prior art itself, and not the appellant’s achievement, that must establish the obviousness of the combination.”¹² It is well established that when a rejection for obviousness depends on a combination or modification of elements disclosed in prior art references, it is important for the Examiner to supply some reason to combine or modify those particular elements in the prior art as a whole.¹³ The Examiner has not provided any such reason.

Indeed, it is very telling that the Examiner has provided no positive reason for why one would use a gate valve with the specific recited valve properties in combination with the other claimed elements. In essence, the Examiner has provided no more reason for the combination than that the valve of Fong could have the relevant characteristics. However, the mere asserted equivalence of functionality of one aspect of the valve, in isolation, cannot be said to overcome the clear teachings away in the art, discussed above.

In the August 2007 Office Action, the Examiner asserted that a 2007 Wikipedia article teaches that gate valves are specifically designed to be fully open/fully closed valves. As an initial point, Appellants note that the article appears to have a July 14, 2007 date. Thus, the article is not prior art to the claimed invention and is not necessarily relevant to what one of skill in the art, at the time of the present invention (at least prior to the January 18, 2000 priority date), would have understood the term to mean. As such, Appellants respectfully submit that the reference is irrelevant to the patentability of the instantly claimed invention.

However, even assuming that the teachings in the Wikipedia article are relevant for some other reason, Appellants note that the full teaching of the article includes the statement “[g]ate valves are sometimes used for regulating flow, but many are not suited for that purpose...” (emphasis added). As such, it is clear that 1) some gate valves are used for regulating flow, and

¹² *In re Dance*, 160 F.3d 1339 (Fed. Cir. 1998).

¹³ *In re Rouffet*, 149 F.3d 1350, 1357, 47 U.S.P.Q.2d 1453, 1456 (Fed. Cir. 1998); *see also, In re Werner Kotzab*, 217 F.3d 1365, 1371, 55 U.S.P.Q.2d 1313, 1317 (Fed. Cir. 2000) and *KSR International v. Teleflex*, 127 S.Ct. 1727 at 1741 (2007).

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that 2) the type of gate valve and its properties will vary depending upon the context in which it is used. As repeatedly stated by the Appellants, in the presently claimed context, the art taught that restriction and flow control was important. Thus, the Wikipedia article does not supply some implicit reason for the combination asserted by the Examiner, but merely confirms that the properties of these valves will vary depending upon how and where they are used, and that one should look to how and where they are used in order to determine the appropriate valve to use. As described above, when one reviews the art, it is clear that the art did not consider a fully opening valve relevant for this particular application. As such, Fong, even in combination with the Wikipedia article, does not suggest that the specifically recited valve from the claimed invention should be used.

Furthermore, Appellants note that Fong, generally, cannot be said to teach or suggest the importance of minimizing restriction at the recited location. For example, Fong teaches a mixing block between the two chambers. As will be appreciated by one of skill in the art, this also presents a flow restriction arrangement,¹⁴ further confirming that one of skill in the art would not have interpreted Fong as providing any reason to select a valve that withdraws completely from the flow path or presents a low pressure differential, contrary to the teachings away.

Moreover, it is clear from this disclosure that Fong did not appreciate the importance or relevance of having a valve that opens as recited in the present claims, as the other aspects of the device would appear to generally counteract such an arrangement. As Fong did not appreciate the usefulness of the presently claimed valve, it is doubtful that one of skill in the art, simply reading Fong and the other cited references, would have been motivated to make the claimed combination, as suggested by the Examiner.

In light of the above, Appellants submit that the first general ground of rejection is inadequate for at least the reasons noted above.

¹⁴ This is clearly shown in FIG. 3, where the bottom of the outer passage 297 is the same size as the passage 293, but is obstructed by inner passage 295. As such, there is clearly some restriction in the passage way between the two chambers.

Second General Grounds of Rejection

In the second general ground of rejection, the Examiner has further cited Hackman for teaching a specific type of gate valve. However, as above, the Examiner has not supplied any positive reason for including Hackman's valve in the claimed combination. The Examiner has generally asserted that one of skill in the art would be motivated to replace the gate valve in Fong with Hackman's gate valve because it is only "generically described" in the other reference. Appellants respectfully disagree. As noted herein, Fong is silent in regard to the specific properties of gate valve. More importantly, the other aspects taught in Fong and the other art suggest that restriction and flow control is acceptable and desirable. Furthermore, it is clear from the art noted above (including the '778 patent) that the properties of the valve in Hackman were not considered important for this context by those of skill in the art. As such, there would appear to be no reason to use the valve of Hackman in the asserted combination with Fong.

It may be that the Examiner is asserting that any gate valve would have worked in the specific arrangement, and as such, the use of a particular gate valve would have been obvious. Appellants note that these valves are not simply interchangeable valves that result in equivalent or expected results. As taught in the specification (paragraph 0026 in the published application), the use of this specific type of valve has specific advantages, which were not previously appreciated by one of skill in the art.¹⁵ In addition, as noted above, the art taught the importance of flow restriction, and thus taught away from the claimed combination. As such, this is not

¹⁵ "As a result of ...[the use of a through-flow type valve], the following advantages can be realized: use of rectilinear piping with a large internal diameter and a valve that does not restrict flow between the remote plasma discharge chamber and the reaction chamber, deactivation (recombination) of fluorine active species is reduced, due to reduced collisions with the piping surface and structure within the valve. Accordingly, applying radio frequency power of less than 3,000 W to the remote plasma discharge chamber, high-speed cleaning at over 2 micron/min becomes possible. Furthermore, reduced collisions also minimizes thermal energy generated when fluorine active species is deactivated, thus reducing overheating of the piping and the valve. Heat damage to O-rings and other components, and consequent generation of particles is also reduced or eliminated. The frequency with which damaged parts are replaced thus decreases, and operating costs of the device can be decreased while at the same time increasing productivity of the device" Paragraph 0026.

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simply a situation where a variety of elements are being combined to produce “predictable results”. Rather, the present combination would have been counter-intuitive to one of skill in the art and resulted in a superior product.

In light of the above, it is clear that neither of the Examiner’s general grounds of rejections include a relevant reason for why one of skill in the art would have selected a gate valve with the explicitly recited characteristics in the particularly claimed combination involving Fong. Rather, the Examiner’s provided reason, which applies equally to all gate valves, merely emphasizes the hindsight employed by the Examiner to select this particular gate valve. In light of the above, Appellants submit that there is no reason to replace the valves used in the prior art with fully opening gate valves and that the Examiner has not established a *prima facie* case of obviousness.

3. *The Examiner has not Demonstrated that the Claimed Valve is Inherently Taught by FIGs 6A and 3 of Fong*

It appears that the Examiner believes that the term “gate valve” in Fong inherently meets the limitations of Claims 1 (pressure drop of less than 0.25 mTorr when open) and Claim 9 (no internal projection and opening as wide as the piping). In support of this, the Examiner has cited an excerpt from a 2007 Wikipedia article to apparently demonstrate the knowledge of one of ordinary skill in the art. (Office Action mailed August 2, 2007, Office Action mailed, April 1, 2008). While the Examiner asserts that this article shows that Fong inherently teaches the claimed valve, in actuality, this article clearly establishes that Fong does not inherently teach the presently recited valve. For example, the Wikipedia article states that “[g]ate valves are sometimes used for regulating flow, but many are not suited for that purpose...when fully open, the typical gate valve has no obstruction in the flow path...”

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It is well established law that the fact that a certain characteristic may be present in the prior art is not sufficient to establish the inherency of that characteristic.¹⁶ Rather, "[t]o establish inherency, the extrinsic evidence 'must make clear that the missing descriptive matter is necessarily present in the thing described in the reference... Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient.'"¹⁷ Thus, even assuming that the Wikipedia article could qualify as prior art for the presently claimed invention (which it does not appear to as the Wikipedia website was started in 2001, while the present application has a priority date of 2000), the article clearly notes that not every "gate valve" has to be configured so that the valve body can be completely removed from the flow path. In other words, Fong's "gate valve" is not necessarily the correct valve. As such, it cannot inherently teach the missing element.

In addition, Appellants note that they previously submitted a declaration by one of skill in the art, Kiyoshi Satoh that discusses how one of skill in the art would view the actual teachings of the relevant valve in Fong. Mr. Satoh's declaration clearly establishes that Fong does not necessarily teach the relevant valve in the two cited figures (FIGs. 6a and 3) because there is no clear disclosure of a valve body, how it works, or where the valve body is located when the valve is opened. The Wikipedia article cited by the Examiner in the Final Office Action does not rebut this, and indeed is consistent with Mr. Satoh's previous statement.

In the most recent Office Action, the Examiner has asserted that "opening a gate valve part way erodes the gate and causes the valve to leak." (O.A. p. 13). As an initial point, Appellants have found no support for the Examiner's assertion. Appellants request that such

¹⁶ *In re Rijckaert*, 9 F.3d 1531, 1534, 28 USPQ2d 1955, 1957 (Fed. Cir. 1993) (reversed rejection because inherency was based on what would result from optimization of conditions, not what was necessarily present in the prior art); *In re Oelrich*, 666 F.2d 578, 581-82, 212 USPQ 323, 326 (CCPA 1981).

¹⁷ *In re Robertson*, 169 F.3d 743, 745, 49 USPQ2d 1949, 1950-51 (Fed. Cir. 1999). See also, *Ex parte Levy*, 17 USPQ2d 1461, 1464 (Bd. Pat. App. & Inter. 1990) "In relying upon the theory of inherency, the examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art."

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support be provided if the Examiner intends to rely upon this assertion for some reason. Regardless, Appellants see no reason to believe that this would be a concern that is unique to gate valves over any other valve system, as any valve system that restricts the flow would be expected to experience some friction along the restricting portion of the valve.

As a final point, Appellants note that they are not arguing that Fong fails to teach a gate valve, but that the gate valve taught in Fong is not inherently the type of valve that is recited in the present claims.

In light of this, Appellants submit that not every element has been taught by the cited art. As such, a *prima facie* case of obviousness has not been established by the present rejection.

E. *The Elements Recited in Claim 19 are a Nonobvious Combination*

It is noted that Claim 19 recites a structure that allows the cleaning gas to flow from the remote plasma discharge chamber to the reaction chamber without obstruction. While the Examiner has asserted that Noble et al. teaches that the reactive species can pass from the remote plasma source to the reaction chamber without obstruction, Appellants respectfully submit that the Examiner has mischaracterized the actual teachings of Noble. Rather than teaching that the species should flow between the two chambers without obstruction, Noble merely schematically depicts a generic passage between the two chambers. Noble is silent with respect to what should or should not be present within the passageway. Indeed, while Noble emphasizes the importance of the entrance 320 being smaller than the exit 375, Noble appears to be silent in regard to the properties of the relevant flow path 360. In the most recent Office Action, the Examiner has asserted that Figure 6 is not generically drawn but “clearly shows that there is nothing in the flow passage...” (Office Action, p. 13). From this, absence of any obstruction, the Examiner has concluded that Fong positively teaches that there should be no obstruction. Appellants respectfully note that if one were allowed to so interpret the absence of various elements from figures as a positive teaching of the absence of the element, then logically, Noble would also teach away from the use of any valve in the piping, as there is no valve present in FIG. 6. Of course, if such were the interpretation of Noble, then it would be impermissible to combine the

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reference with Fong, as Noble would teach away from such a combination. As such, Appellants respectfully submit that, even if the Examiner's interpretation of the figures in Noble correct, then it would still be impermissible to combine the references as suggested by the Examiner.

Moreover, Appellants note that the mixing block in Fong (item 273) would prevent the "without obstruction" element from being present as recited in the claims. Furthermore, as noted above, a "without obstruction" element was clearly taught away from by the references that emphasized the importance of flow restriction.

In the latest Office Action, the Examiner has asserted that:

[o]ne of ordinary skill in the art reading Noble et al. would be motivated to rearrange the plasma supply line of Fong et al. such that it did not pass through the mixing block and was directly aligned with the plasma inlet, thus, providing a direct supply to the plasma apparatus.

(O.A. p. 14) Appellants respectfully disagree. The mixing block taught in Fong appears to be an important part of Fong's invention, and is specifically noted as one of Fong's inventive aspects (col. 10, lines 26-37). Indeed, Fong explicitly states that the mixing block is used in the "in situ cleaning method of the *present invention*..." (emphasis added, col. 10, lines 34-36). Thus, there is no reason why one of skill in the art would remove such a valuable and highly relevant part of Fong's device in the manner suggested by the Examiner. As such, Appellants respectfully submit that one of skill in the art would not have combined the teachings of Noble and Fong in the manner suggested by the Examiner. Indeed, if anything, it appears that the Examiner's proposed aspects from Fong and Noble are incompatible.

F. Claims 2, 3, 5, 6, 8, 10, 14-19, and 45

Claims 2, 3, 5, 6, 8, 10, 14-19, and 45 depend from above noted novel and nonobvious Claim 1 and are therefore novel and nonobvious as well.

Claims 10 and 14-19 were further rejected over various combinations that include two additional references, Ikeda or Noble. However, all of the Examiner's rejections relied upon the above noted core rejections, which, for the reasons outlined above, are inadequate to establish a *prima facie* case of obviousness. As neither of these additional references remedy the above

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noted failings in the core rejections or rebut the above noted teachings away that are of record, Appellants submit that Claims 10 and 14-19 are clearly novel and nonobvious for at least the reasons noted above, as well as for their additionally recited elements.

VIII. CONCLUSION

Even assuming, *in arguendo*, that a *prima facie* case had been established in the previous rejection, it is clear that the art generally taught away from the combination of the elements as recited in the claims. As such, any *prima facie* showing of obviousness has been rebutted by the actual teachings away in the prior art. Moreover, because the Examiner has not provided an adequate reason for combining the particularly recited valve in the particularly recited combination and because each of the elements has not been taught by the cited references (in regards to the first ground of rejection), the Examiner has also failed to establish a *prima facie* showing of obviousness.

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IX. SUMMARY OF CLAIMS APPENDIX

Attached hereto as Appendix A is a copy of the claims on appeal.

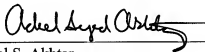
X. SUMMARY OF EVIDENCE APPENDIX

Attached hereto as Appendix B is a copy of Shang (U.S. Pat. No. 5,788,778), U.S. Pat. No. 6,274,058, Sun (U.S. Pat. Pub. No. 2002/0033183), Yin et al., (PCT Pub. No. WO 99/20812), Fukuda (U.S. Pat. Pub. No. 2005/0139578), and Shang (EP 0697467)) references of record and discussed in the Response mailed August 18, 2006. Additionally, a copy of the signed declaration, submitted to the Examiner in the Response dated January 12, 2007 is also included.

XI. SUMMARY OF RELATED PROCEEDINGS APPENDIX

No related appeal proceedings are known.

Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.



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APPENDIX A
(Claims as finally rejected)

1. A chemical vapor deposition (CVD) device comprising
 - a deposition reaction chamber;
 - a plasma discharge chamber that is provided remotely from the reaction chamber, wherein the plasma discharge chamber comprises 1) a wall that comprises an aluminum alloy, wherein the wall is exposed to plasma discharge, and 2) a radio-frequency (RF) energy source connected to plasma discharge chamber electrodes;
 - a source of a cleaning gas, wherein the source of the cleaning gas is connected to the plasma discharge chamber;
 - a piping that links the reaction chamber and the remote plasma discharge chamber; and
 - a valve positioned in the piping, wherein the valve has an opening that, when fully open, defines a pressure drop across the valve of less than about 0.25 Torr,
 - wherein energy coupled to the remote plasma discharge chamber activates cleaning gas within the plasma discharge chamber, and the activated cleaning gas is exposed to the aluminum alloy wall and brought into the inside of the reaction chamber through the piping and changes solid substances adhered to the inside of the reaction chamber as a consequence of film formation, to gaseous substances, thereby cleaning the inside of the reaction chamber.

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2. The CVD device according to Claim 1, wherein the activated cleaning gas comprises fluorine active species.

3. The CVD device of Claim 2, wherein the internal surface of the piping comprises a metal not corroded by the activated cleaning gas species, wherein said metal is selected from the group consisting of: aluminum and aluminum alloy.

5. The CVD device of Claim 1, wherein the piping and the valve are configured so that no appreciable pressure loss arises in the piping and at the valve when the cleaning gas flows between the remote plasma discharge chamber and the reaction chamber.

6. The CVD device of Claim 5, wherein the activated cleaning gas comprises fluorine active species and an inner surface of the valve is made of fluorine-passivated aluminum.

8. The CVD device of Claim 1, wherein the pressure drop across the valve when fully open is less than about 0.1 Torr.

9. A chemical vapor deposition (CVD) device comprising:

a deposition reaction chamber;

a plasma discharge chamber that is provided remotely from the reaction chamber;

wherein the plasma discharge chamber comprises 1) a wall that comprises an aluminum alloy, wherein the wall is exposed to plasma discharge, and 2) a radio-frequency (RF) energy source connected to plasma discharge chamber electrodes;

a source of a cleaning gas, wherein the source of the cleaning gas is connected to the plasma discharge chamber;

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a piping that links the reaction chamber and the remote plasma discharge chamber; and

a valve positioned in the piping, wherein an opening of the valve is sized, when fully opened, substantially equal in width to an inner surface of the piping, and the valve does not have projections, when fully opened, with respect to the inner surface of the piping,

wherein energy coupled to the remote plasma discharge chamber activates cleaning gas within the plasma discharge chamber, and the activated cleaning gas is exposed to the aluminum alloy wall and brought into the inside of the reaction chamber through the piping and changes solid substances adhered to the inside of the reaction chamber as a consequence of film formation, to gaseous substances, thereby cleaning the inside of the reaction chamber.

10. The CVD device of Claim 1, wherein the piping and the valve are heated to a temperature effective to prevent deposition of the cleaning gas.

14. The CVD device of Claim 1, wherein the piping is straight between the remote plasma discharge chamber and the reaction chamber.

15. The CVD device of Claim 1, wherein the energy activating the cleaning gas has a frequency between about 300 kHz and 500 kHz.

16. The CVD device of Claim 14, wherein the energy activating the cleaning gas has a power between about 1,500 W and 3,000 W.

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17. The CVD device of Claim 1, further comprising a reaction gas inlet and a reaction gas outlet defining a horizontal flow across a substrate surface upon which material is deposited within the reaction chamber.

18. The CVD device of Claim 17, wherein the piping opens into the reaction chamber downstream of the inlet and upstream of a substrate support configured for supporting a substrate within the chamber.

19. The CVD device of Claim 14, wherein when the valve is open, a cleaning gas can flow from the remote plasma discharge chamber to the reaction chamber without obstruction, and wherein the piping is at least 1/2 inch in diameter.

45. The CVD device of Claim 1, wherein the wall made of aluminum alloy of the remote plasma discharge chamber comprises anodized aluminum alloy.